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Wikipedia audio article Can Slime Mould Solve Mazes?

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This book is devoted to Slime mould *Physarum polycephalum*, which is a large single cell capable for distributed sensing, concurrent information processing, parallel computation and decentralized actuation. The ease of culturing and experimenting with *Physarum* makes this slime mould an ideal substrate for real-world implementations of unconventional sensing and computing devices. The book is a treatise of theoretical and experimental laboratory studies on sensing and computing properties of slime mould, and on the development of mathematical and logical theories of *Physarum* behavior. It is shown how to make logical gates and circuits, electronic devices (memristors, diodes, transistors, wires, chemical and tactile sensors) with the slime mould. The book demonstrates how to modify properties of *Physarum* computing circuits with functional nano-particles and polymers, to interface the slime mould with field-programmable arrays, and to use *Physarum* as a controller of microbial fuel cells. A unique multi-agent model of slime is shown to serve well as a software slime mould capable for solving problems of computational geometry and graph optimization. The multiagent model is complemented by cellular automata models with parallel accelerations. Presented mathematical models inspired by *Physarum* include non-quantum implementation of Shor's factorization, structural learning, computation of shortest path tree on dynamic graphs, supply chain network design, p-adic computing and syllogistic reasoning. The book is a unique composition of vibrant and lavishly illustrated essays which will inspire

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scientists, engineers and artists to exploit natural phenomena in designs of future and emergent computing and sensing devices. It is a 'bible' of experimental computing with spatially extended living substrates, it spanstopics from biology of slime mould, to bio-sensing, to unconventional computing devices and robotics, non-classical logics and music and arts.

This book presents fundamental theoretical results for designing object-oriented programming languages for controlling swarms. It studies the logics of swarm behaviours. According to behaviourism, all behaviours can be controlled or even managed by stimuli in the environment: attractants (motivational reinforcement) and repellents (motivational punishment). At the same time, there are two main stages in reactions to stimuli: sensing (perceiving signals) and motoring (appropriate direct reactions to signals). This book examines the strict limits of behaviourism from the point of view of symbolic logic and algebraic mathematics: how far can animal behaviours be controlled by the topology of stimuli? On the one hand, we can try to design reversible logic gates in which the number of inputs is the same as the number of outputs. In this case, the behaviouristic stimuli are inputs in swarm computing and appropriate reactions at the motoring stage are its outputs. On the other hand, the problem is that even at the sensing stage each unicellular organism can be regarded as a logic gate in which the number of outputs (means of perceiving signals) greatly exceeds the number of inputs (signals).

The unconventional computing is a niche for interdisciplinary science, cross-bred of computer

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science, physics, mathematics, chemistry, electronic engineering, biology, material science and nanotechnology. The aims of this book are to uncover and exploit principles and mechanisms of information processing in and functional properties of physical, chemical and living systems to develop efficient algorithms, design optimal architectures and manufacture working prototypes of future and emergent computing devices. This second volume presents experimental laboratory prototypes and applied computing implementations. Emergent molecular computing is presented by enzymatic logical gates and circuits, and DNA nano-devices. Reaction-diffusion chemical computing is exemplified by logical circuits in Belousov-Zhabotinsky medium and geometrical computation in precipitating chemical reactions. Logical circuits realised with solitons and impulses in polymer chains show advances in collision-based computing. Photo-chemical and memristive devices give us a glimpse on hot topics of a novel hardware. Practical computing is represented by algorithms of collective and immune-computing and nature-inspired optimisation. Living computing devices are implemented in real and simulated cells, regenerating organisms, plant roots and slime mould. The book is the encyclopedia, the first ever complete authoritative account, of the theoretical and experimental findings in the unconventional computing written by the world leaders in the field. All chapters are self-contained, no specialist background is required to appreciate ideas, findings, constructs and designs presented. This treatise in unconventional computing appeals to readers from all walks of life, from high-school pupils to university professors, from

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mathematicians, computer scientists and engineers to chemists and biologists.

Myxomycetes: Biology, Systematics, Biogeography and Ecology, Second Edition provides a complete collection of general and technical information on myxomycetes microorganisms. Its broad scope takes an integrated approach, considering a number of important aspects surrounding their genetics and molecular phylogeny. The book treats myxomycetes as a distinct group from fungi and includes molecular information that discusses systematics and evolutionary pathways. Written and developed by an international team of specialists, this second edition contains updated information on all aspects of myxomycetes. It incorporates relevant and new material on current barcoding developments, plasmodial network experimentation, and non-STEM disciplinary assimilation of myxomycete information. This book is a unique and authoritative resource for researchers in organismal biology and ecology disciplines, as well as students and academics in biology, ecology, microbiology, and similar subject areas. Written in a simple, concise and relatively non-technical style, allowing for a broad readership within biological, environmental and life science programs at academic and research institutions. Contains the comprehensive body of information available on myxomycetes under one cover, with contributions from the leading authorities in their respective areas of expertise. Provides straightforward, compiled information about myxomycetes and the potential of this group for basic and applied research. Offers completely updated material in every chapter, including new material on barcoding and *Physarum polycephalum*.

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This pioneering text/reference explores how innovative new modes of computation may provide exciting new directions for future developments in the music industry, guiding the reader through the latest research in this emerging, interdisciplinary field. This work includes coverage of electronic music compositions and performances that incorporate unconventional interfacing, hacking and circuit bending. Features: presents an introduction to unconventional computing in music; discusses initiatives involving biophysical electronic music, the work of self-styled silicon luthiers, and the intersection of music and quantum computing; introduces the memristor, a new electronic component with the potential to revolutionize how computers are built; reviews experiments and practical applications of biological memristors in music; describes IMUSIC, an unconventional tone-based programming language, which enables the programming of computers using musical phrases; includes review questions at the end of each chapter.

This book is a tribute to Julian Francis Miller ' s ideas and achievements in computer science, evolutionary algorithms and genetic programming, electronics, unconventional computing, artificial chemistry and theoretical biology. Leading international experts in computing inspired by nature offer their insights into the principles of information processing and optimisation in simulated and experimental living, physical and chemical substrates. Miller invented Cartesian Genetic Programming (CGP) in 1999, from a representation of electronic circuits he devised with

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Thomson a few years earlier. The book presents a number of CGP 's wide applications, including multi-step ahead forecasting, solving artificial neural networks dogma, approximate computing, medical informatics, control engineering, evolvable hardware, and multi-objective evolutionary optimisations. The book addresses in depth the technique of ' Evolution in Materio ' , a term coined by Miller and Downing, using a range of examples of experimental prototypes of computing in disordered ensembles of graphene nanotubes, slime mould, plants, and reaction diffusion chemical systems. Advances in sub-symbolic artificial chemistries, artificial bio-inspired development, code evolution with genetic programming, and using Reed-Muller expansions in the synthesis of Boolean quantum circuits add a unique flavour to the content. The book is a pleasure to explore for readers from all walks of life, from undergraduate students to university professors, from mathematicians, computer scientists and engineers to chemists and biologists.

This book presents comprehensive coverage of the latest advances in research into enabling machines to listen to and compose new music. It includes chapters introducing what we know about human musical intelligence and on how this knowledge can be simulated with AI. The development of interactive musical robots and emerging new approaches to AI-based musical creativity are also introduced, including brain – computer music interfaces, bio-processors and quantum computing. Artificial Intelligence (AI) technology permeates the music industry, from management systems for recording studios to recommendation systems for online commercialization

Online Library Advances In Physarum Machines Sensing And Computing With of music through the Internet. Yet whereas AI for online music distribution is well advanced, this book focuses on a largely unexplored application: AI for creating the actual musical content.

In a world that is changing faster and with more complexity than at any other time in history, Tom Goodell explores how to make sense of it all, and how individuals and organizations can thrive in a world this complex. He taps into hot business management trends of mindfulness, simplicity science, and agile leadership along the way.

Modern computing relies on future and emergent technologies which have been conceived via interaction between computer science, engineering, chemistry, physics and biology. This highly interdisciplinary book presents advances in the fields of parallel, distributed and emergent information processing and computation. The book represents major breakthroughs in parallel quantum protocols, elastic cloud servers, structural properties of interconnection networks, internet of things, morphogenetic collective systems, swarm intelligence and cellular automata, unconventionality in parallel computation, algorithmic information dynamics, localized DNA computation, graph-based cryptography, slime mold inspired nano-electronics and cytoskeleton computers. Features Truly interdisciplinary, spanning computer science, electronics, mathematics and biology Covers widely popular topics of future and emergent computing technologies, cloud computing, parallel computing, DNA computation, security and network analysis, cryptography, and theoretical computer science Provides unique chapters written by top

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experts in theoretical and applied computer science, information processing and engineering From Parallel to Emergent Computing provides a visionary statement on how computing will advance in the next 25 years and what new fields of science will be involved in computing engineering. This book is a valuable resource for computer scientists working today, and in years to come.

This book constitutes the proceedings of the 13th International Conference on Cellular Automata for Research and Industry, ACRI 2018, held in Como, Italy, in September 2018. The 47 full papers presented in this volume were carefully reviewed and selected from 64 submissions. This volume contains invited contributions and accepted papers from the main track and from the three organized workshops. The volume is organized in the following topics: biological systems modeling; simulation and other applications of CA; multi-agent systems; pedestrian and traffic dynamics; synchronization and control; theory and cryptography; asynchronous cellular automata; and crowds, traffic and cellular automata.

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